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PERFORMANCE WORK STATEMENT

FOR

NATO IMPROVED LINK ELEVEN (NILE)

IN-SERVICE SUPPORT (ISS) PHASE

BLOCK CYCLE UPDATES AND ENGINEERING/MANAGEMENT SERVICES

Prepared by: NILE Project Management Office (PMO)

REVISION HISTORY

Version	Reason for Change	Date

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1 SCOPE

1.1 Introduction

The Space and Naval Warfare Systems Command (SPAWAR), in support of the Program Executive Office Command, Control, Communications, Computers, and Intelligence (PEO C4I), Navy Command and Control Program Office (PMW 150), is initiating an In-Service Service (ISS) contract on behalf of the North Atlantic Treaty Organization (NATO) Improved Link Eleven (NILE) participants.

This In-Service Support Performance Work Statement (PWS) establishes the requirements for the continued Modification, Maintenance, and Configuration Control of the NATO Improved Link Eleven (NILE) IT Products including: the System Network Controller (SNC) Software, the NILE Reference System (NRS) Software and Hardware, and associated documentation. SNC/NRS enhancements due to potential new system capabilities (such as new waveforms) implementation are also expected to be execute under this contract. The impact evaluation of software changes to NILE IT Products (executed under the provisions of this contract) on the Multi-Link System Test and Training Tool (MLST3) is an additional contract requirement. Furthermore engineering and project management services are also required as part of this contract.

2 BACKGROUND

During the late 1980s, NATO, agreeing on the need to improve the performance of Link Eleven (Link 11), produced a mission need statement that became the basis for the establishment of the NILE Project.

The NILE Project was initially developed collaboratively by seven nations under the aegis of a Memorandum of Understanding (MoU). The original seven nations were Canada (CAN), France (FRA), Germany (DEU), Italy (ITA), the Netherlands (NLD), the United Kingdom (UK) and the United States of America (USA). Spain (ESP) replaced the Netherlands in FY2003. The current seven nations are hereinafter referred to as the “NILE Nations”.

This multi-nationally funded project is guided by a Steering Committee (SC) consisting of a Representative appointed by each NILE Nation. The project is managed by the NILE Project Management Office (NILE PMO), located at the Program Executive Office, Command,

Control, Computers, Communications & Intelligence (PEO C4I), Program Management Warfare (PMW) 150.

The NILE PMO consists of one Representative from each NILE Nation and a Project Manager (PM) who is appointed by the United States Department of the Navy and endorsed by the NILE Steering Committee (NILE SC).

The configuration control function is exercised, on behalf of the SC, by a Configuration Control Board (CCB). The CCB is composed of a representative of each NILE Nation and chaired by the NILE PM.

NILE has been designated Link 22 by NATO. Link 22 is a standard for wireless and secure information interchange between military units. Link 22 provides improved High Frequency (HF) and Ultra High Frequency (UHF) radio communications of tactical data. Link 22 offers a more robust terrestrial Beyond Line of Sight (BLOS) Waveform than Link 11. It also provides better Real Time Tactical access compared to Satellite Communications, and improves Allied Interoperability through a Common Design. Link 22 offers a BLOS tactical data link that is designed to fully complement its Link 16 Line of Sight (LOS) counterpart, but without the complex planning, monitoring and network management overhead.

As the project progresses through each life cycle phase, each phase demands a new amendment to the MoU. A summary of the project's life cycle history is as follows:

- Project Definition — Nov 87 – Jun 92 (Completed)
- Design and Development Subphase 1 — Jul 92 – Jun 97 (Completed)
- Design and Development Subphase 2 — Jul 97 – Jun 02 (Completed)
- In-Service Support Phase (Amd 1-3) — Jul 02 – Jan 14 (On-going)

The primary objective of the Design and Development (D&D) Phase of the NILE Project was to design a system consisting of a computer-to-computer, digital data link among Tactical Data System (TDS) equipped platforms, in order to meet the NATO Staff Requirement for NILE. An additional NILE objective of the D&D Phase was to develop common specifications and project information sufficient to enable the participating nations to procure NILE systems which will be interoperable and compatible with those of other nations.

The objective of Subphase 2 of the Design & Development Phase was to design, develop,

build, and test a SNC, a NILE Reference System (NRS) and the Link 22 element of the Multi-Link System Test and Training Tool (MLST3)[1] that met the requirements of the specifications referenced herein, and to develop sufficient technical data to enable each NILE Nation to utilize and maintain the SNC, NRS and MLST3, as part of their national Link 22 implementation programs.

The SNC provides common operational software that is compatible among the seven current NILE Nations. The NRS is a test tool, which will enable compatibility testing of Link 22 implementations by the participating nations. The MLST3 is envisioned as the primary means by which Link 22 interoperability will be validated and will be utilized throughout the ISS Phase to ensure continued interoperability of Allied Forces.

The Link 22 system uses the KIV-21 Link Level COMSEC (KIV021/LLC) device to provide communication security services at the link level. This cryptographic equipment also provides time-of-day (TOD) based encryption and decryption services for network messages sent over multiple NILE transmission networks. A Modernized Link Level COMSEC (MLLC) is being procured to replace the current LLC unit to meet new National Security Agency (NSA) requirements. Technical obsolescence may also occur on other components.

3 OBJECTIVES

The overall objectives of the ISS phase are to provide in-service support for, maintain commonality of, and pursue modifications resulting from user inputs for NILE IT Products. These NILE IT Products include the SNC, NRS, and associated documentation. This PWS defines the effort required from the Contractor in support of the NILE ISS phase objectives achievement.

The NILE PMO recognizes that in order to achieve maximum management efficiency, an overlapping of efforts, such as analysis, design, implementation and engineering support activities may occur and mainly envisions the possibility of requiring the following services:

a. NILE IT Block Cycle Updates, covering:

Analysis and design of items as identified and listed in Appendix C (or a

[1] MLST3 is not a NILE Product, it is under configuration control of SPAWAR SSC Pacific Code 591

selection of), implementation of the recommended solutions determined during the period of performance (including the outcome of the MLLC Full Development Support), and, as a recurring effort for each contractual year, correction items.

The result of the combined analysis, design, and implementation activities (and activities in paragraphs b. and c. below, where applicable) will result in an updated product baseline, labeled “Block Cycle”. Delivery of electronic copies of updated NILE IT Products and execution of formal SW acceptance tests may be required every one or two contractual years.

b. Engineering Services, covering:

System engineering, investigative, technical and maintenance support services for tasks as outlined in this PWS on Link 22-related matters as specified on a Technical Direction Letter by the NILE PMO or by a specific NILE Nations in support of its Link 22 implementation effort. Examples of engineering support might be:

- Execute interoperability tests between Link 22 system devices developed by different vendors and evaluate the results;
- Provide expertise to the NILE PMO or to the Government committed to maintain proper system level integration and compatibility throughout the concurrent MLLC Full Development (FD) effort.

c. Project Management Services, covering:

Establishment of an effective project management structure to oversee execution of tasks directed by this PWS and to provide life cycle support and configuration management of the IT Products delivered.

Throughout this PWS, unless specified otherwise, the term “SNC” implicitly encompasses all existing SNC variants as defined in request for proposal (RFP) Section H. Similarly, the term “NRS” implicitly encompasses the Scenario Generator (SG) Computer Software Configuration Item (CSCI), NRS Hardware Configuration Item (HWCI) and the Media Simulator (MS) CSCI as defined in documentation listed in Appendix D – Paragraph 2.1.

Throughout this PWS, the terms "Contractor" and “ISS-Contractor” refer to the Contractor

selected for evolving and maintaining the NILE products during the ISS Follow-On contract phase, the term "Government" refers to the United States Government (encompassing the NILE Project Management Office and the NILE nations). The term “MLST3-ISEA” refers to the In-Service Engineering Agent-entity (SSC Pacific Code 591) contracted for supporting the overall MLST3 maintenance activities, which are outside of the scope of this PWS. The following Figure 1 provides a high level identification of the areas of the ISS-Contractor responsibilities.

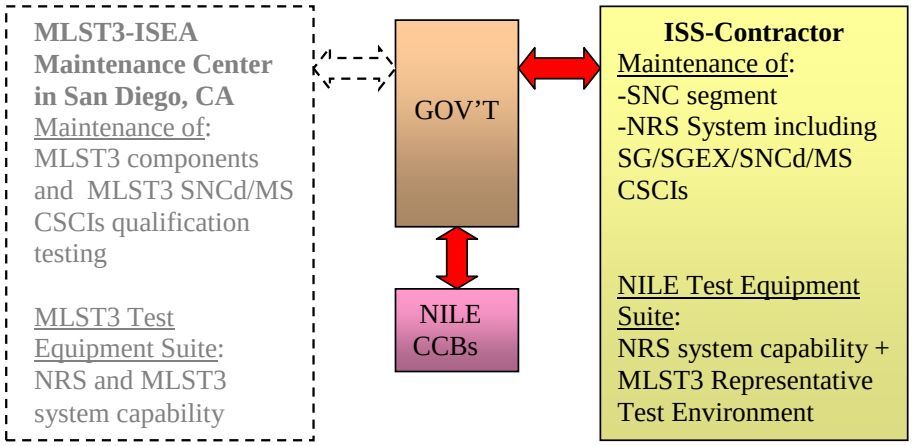


Figure 1: High-Level Identification of support and Test Equipment required for organizational-level maintenance items

Prior to and following any changes implemented on the SNC and NRS segment, the Contractor will evaluate and provide an assessment of the impact on the MLST3 Link 22 components.

The Contractor will analyze, design, implement, integrate and test the required modifications to produce an updated version of the SNC and/or NRS in accordance with the objectives defined in this paragraph.

The software modifications will be validated in the NRS, and will be delivered to the Government as an incremental version from the baseline version. Effective implementation by the NILE community of the latest version will be a national decision and may occur sometime after a “block” delivery.

The Contractor will generate sufficient technical data to enable each participating nation to maintain the SNC and NRS, as part of their national NILE, or Link 22 implementation program.

4 APPLICABLE DOCUMENTS

The following documents are provided as applicable references; as these documents are subject to update, the Contractor shall adhere to the most current version, as required.

4.1 Specifications

The baseline documents are specified in Appendix D – Paragraph 2.

4.2 Standards

MIL-HDBK-61A(SE)	Configuration Management Guidance, February 2001
MIL-PRF-49506	Performance Specification Logistic Management Information, 11 November 1996
STANAG 4107	Mutual Acceptance of Government Quality Assurance Edition 6, Amendment 1, 28 April 1998
MIL-STD-882D	DEPARTMENT OF DEFENSE Standard Practice for System Safety, 10 February 2000
ANSI/EIA 649	National Consensus Standard for Configuration Management, 10 July 1998
NATO SDIP-29	Installation of Electrical Equipment for the Processing of Classified Information, Jan 2006.

4.3 NILE Documents

NILE PMP	NILE Program Management Plan
NILE CMP	NILE Configuration Management Plan
WP (#3)	Network independent SG EX
WP (#20)	DR Time Tag selection
WP (#21)	DR Filters enhancement
WP (#25)	Link 22 Diagnostics
WP (#31)	HF FF extension, System Impact Analysis
WP (#36)	NMU's SN Dir update of DTDMA Flag
WP for Item 33	Backward Compatibility of Future Releases

WP for Item 40	Network Management Retransmission
WP for Item 50 (#32)	Bulk Data / File Transfer Protocol
PCR #73	LNE NCS Timeslot Size Constraint Error
PCR #82	LNE failure when LNU in MASN but not in ONCS

4.4 NATO Standards and Documents (latest edition)

STANAG 4203	Technical standards for single channel radio equipment
STANAG 4205	Technical standard for single channel UHF radio equipment
STANAG 4285	Characteristics of 1200/2400/3600 bits per second single tone modulators demodulators for HF radio links
STANAG 4372	SATURN – A fast frequency hopping ECCM mode for UHF radio
STANAG 4430	Precise time and frequency interface and its management for military electronic systems
STANAG 4444	Technical standards for a slow hop HF EPM Communications system
STANAG 4539	Technical standards for non hopping HF communication waveforms
STANAG 5516	TACTICAL DATA EXCHANGE - LINK 16
STANAG 5522	TACTICAL DATA EXCHANGE - LINK 22
STANAG 5602	STANDARD INTERFACE FOR MULTIPLE PLATFORM LINK EVALUATION (SIMPLE)
STANAG 5616	Volume II - Standards for Data Forwarding Between Tactical Data Systems Employing Digital Data Link 16 and Tactical Data Systems Employing Link 22
	Volume III - Standards for Data Forwarding Between Tactical Data Systems Employing Digital Data Link 11/Link 11B and Tactical Data Systems Employing Link 22
AdatP 33	Multi-Link Standard Operating Procedures for Tactical Data Systems Employing Link 11, Link 11B, Link 16, IJMS and Link 22

EXTAC 779	Draft Link-22 OPTASK LINK message (OLM)
AdatP – 3	NATO MESSAGE TEXT FORMATTING SYSTEM (FORMETS) – CONCEPT OF FORMETS (CONFORMETS)

4.5 Other documents

ISO 9001	Quality Management Systems – Requirements, Third Edition, 15 December 2000
ISO 10007	Quality Management-Guidelines for Configuration Management for SNC and NRS Development, 1995
ISO/IEC 8652	Information technology, programming languages – Ada (ISO/IEC 8652: 1995) with COR.1: 2000 Ada Reference Manual, 15 June 2001
IEEE/EIA 12207	Industry Implementation of International Standard ISO/IEC 12207 – 1995 (ISO/IEC 12207) Standard for Information Technology – Software Life Cycle Process, 01 March 1998
VSD-608518-98-355-01	LLC Operator’s Manual, Spares List, and System Integrator's Guide
PI-L22D-RM-03	LINK-22 Modernized Link Level COMSEC (MLLC) System/Subsystem Specification

5 PERFORMANCE REQUIREMENTS (NILE NATIONS/US OMN)

During the period of performance of the contract, and when tasked by Technical Direction Letters (TDLs), the Contractor shall provide services according to the following specific requirements. TDLs will provide specific information relating to the tasks contained in this PWS and will be provided to the contractor in writing.

5.1 BLOCK CYCLE UPDATES AND ENGINEERING/PROJECT MANAGEMENT SERVICES FOR NILE IT SYSTEMS (CLINS X001/X004)

5.1.1 NILE IT BLOCK CYCLE UPDATES (CLIN X001)

The Contractor **shall**[(1)] be responsible for the following tasks:

a. Conducting technical and support analyses and designing of SNC and NRS modifications and issue resolution as assigned by the Government;
b. Identifying change requirements and recommending change proposals;
c. Coding, integrating and testing changes when approved;
d. Updating NILE documentation to reflect software changes. Updates **shall**[(2)] be approved through the Configuration Management Change Proposal process as detailed in Section 5.1.3.11 of the PWS;
e. Providing an impact assessment on the MLST3 CSCIs (prior to performing any code changes) in sufficient detail to enable the Government to contract for the relevant changes on the MLST3 CSCIs with the MLST3 ISEA;
f. Providing updated relevant baseline documentation, and the SNC, MS, and NRS executable code as a minimum, to the MLST3 ISEA upon approval of code changes with MLST3 impact;
g. Analyzing deficiencies identified within the SNC and NRS software versions;
h. Investigating possible deficiencies in the NILE systems as they are reported by individual NILE participants in the course of their national NILE system integration (to the extent that such items or services do not adversely impact NILE Project products or compatibility or interoperability among the NILE systems of the participants);
i. Tracking software/hardware obsolescence and maintaining interoperability among all identified platforms;
j. Mitigating software/hardware obsolescence and maintaining interoperability among all identified platforms.
k. Performing modification, implementation and validation of test cases to demonstrate the modified functionality, making full use of existing SNC and NRS

CSCI and System Qualification Test procedures and scenarios.

Appendix C defines the work package currently identified for the entire contract period. Each Block Cycle will contain a combination of analysis, design, implementation and engineering tasks. As the tasking is often related and frequently overlapping, the detailed content of the potential follow-on Block Cycles will be defined through a proper TDL.

The Software Modification Process approach for Block Cycle Seven and following is illustrated in Appendix A Figure 1. The Contractor **shall**(3) deliver a new release of the documentation in Appendix D and of the SW CSCIs (both source and executable) upon completion of each Block Cycle as specified on a TDL.

Whenever analysis and design proposals are required, the Contractor **shall**(4) provide White Papers (WP) to allow an interactive dialogue with the Government, before any solutions are implemented. When existing functionality is removed, the Contractor **shall**(5) maintain a history of the deleted or modified lines of code, relative to the baseline software. The Contractor **shall**(6) amend the software design documentation to describe the "sidelining" of the existing functionality. The Contractor **shall**(7) amend the specification documentation to reflect the modified baseline requirements, deleting existing functionality requirements as necessary. The CM process (as per paragraph 5.1.3.11) will maintain the old versions of documentation (CDRL A004).

Any changes to the SNC which result in an updated version of the software **shall**(8) be backward compatible with the SNC version 9.X, or anyway as directed by the NILE PMO on a TDL. Detailed considerations on how backward compatibility is handled between minor releases (e.g. SNC v9.5 to SNC v.9.6) can be found in WP "Item 33 - Backward Compatibility Improvements_2.doc" as per paragraph 4.3. This WP was part of the BC3 Release and gives an indication that for any modifications that would not be backward compatible a major version release would be used (e.g. SNC v9.X to SNC v10.0).

Additionally the Contractor **shall**(9) provide technical support, analysis, and design activities necessary to support current and evolving Link 22 interfaces and specifications including COMSEC, SPC, and Radio sub-systems. These activities **shall**(10) be performed as specified on a TDL and with reference both to the waveforms presently used by the Link 22 system, as well as to potential new waveforms.

5.1.1.1 Generic Software Development Approach

The SNC has been developed in a single software environment, Intel Pentium and Windows XP, and then modified to function under the LINUX and Windows 7 software, using an Intel platform. The extension to different and performing Operating Systems or Platforms might

also be evaluated by the Government in the future. Details about the actual baseline Software Development Plan (SDP) are provided in the existing Program Management Plan [PMP] for the NILE ISS Phase available for reference upon request from the NILE PMO. Any modification of software **shall**[(1)] meet the requirements specified in Paragraph 5.1. The Contractor **shall**[(2)] modify software using the mandated computer platform types to meet the requirements outlined in this PWS. The Contractor **shall**[(3)] identify in the PMP (CDRL A001) those software management indicators to be used, and **shall**[(4)] collect, interpret, apply, and report (CDRL A005) on those indicators which provide a quantitative measurement of schedule and progress, quality, and technical adequacy of software modification.

5.1.1.1.1 Software Language Requirements

The Contractor **shall**[(1)] perform the SNC/SNCd software modifications using Ada 95, as defined by ANSI/ISO/IEC 8652:1995. The software modifications to the NRS CSCIs **shall**[(2)] be performed using C++. The Government reserves the right to evaluate/approve more advantageous programming languages during contract performance.

5.1.1.1.2 Processing Capacity

The Contractor **shall**[(1)] estimate the modified SNC and NRS processing capacity using appropriate peak throughput scenarios. The estimated spare processor capacity **shall**[(2)] be presented to the PMO, and then verified during system qualification testing of final delivered software.

5.1.1.1.3 Memory Capacity

The revised memory capacity and utilization for each Central Processing Unit (CPU) **shall**[(1)] be also estimated. Measurements of memory capacity and utilization for each CPU **shall**[(2)] be verified during system qualification testing.

5.1.1.1.4 Software Version Identification

The Software Version identification is provided in Section H of the RFP.

5.1.1.2 SNC and NRS System/Segment Design change

The Contractor **shall**[(1)] perform engineering design studies to define the modified design, configuration, and performance characteristics of the SNC and NRS software, in accordance with the requirements of the current Segment Specifications and the list of specified

functional modifications in Appendix C. The design **shall**(2) be carried to a level of detail such that the necessary modified segment components (including computer resources) and their functional characteristics are identified; the external and major internal hardware and software interfaces are characterized as to function; the physical layout of the segment is described, and feasibility, cost effectiveness, and reproducibility of the design are verified. If the documents, specified at Appendix D are to be modified, change pages **shall**(3) be provided via Change Proposal (CP). Design changes resulting from modifications **shall**(4) be documented through company procedures/processes and delivered as Natural Work Product (NWP) (as part of CDRL A011). However, an update to the current SNC Software Design Description (SDD) **shall**(5) be provided upon SNC modification evolution(s). The Contractor **shall**(6) deliver a Software Version Description (SVD) (CDRLs A009 and A014) document to control and track the software release.

When specified on a TDL the Contractor **shall**(7) deliver, on electronic media, all the source and executable files, including any batch files, command files, data files or other software files needed to regenerate the executable software and to install and operate the software on its target computer (CDRLs A010 and A0015).

5.1.1.3 Technical Data Package (TDP)

The Contractor **shall**(1) generate and maintain a TDP (CDRL A011) which details all information and requirements pertaining to the upgrade, testing, installation, training, and support for the SNC and NRS. As specified on a TDL, an updated TDP **shall**(2) be delivered on completion of each Block Cycle. The TDP **shall**(3) constitute a complete design disclosure of the SNC and NRS necessary for the Government to build an identical system via a third party. The TDP **shall**(4) include engineering design documentation baseline (Appendix D Paragraph 2.1), specifications, product drawings and associated lists, special tooling and test equipment drawings and associated lists, technical manuals, commercial off the shelf (COTS) manuals, source and object code listings, software documentation, test plans and procedures, installation drawings, support documentation, and configuration changes. COTS manuals **shall**(5) consist of only the information that is normally supplied by the vendor. The TDP **shall**(6) not include any COMSEC/TEMPEST information or requirements. The TDP **shall**(7) exactly represent the as-built configurations of the modified SNC and NRS that successfully completed Block Cycle Testing.

5.1.1.3.1 System Technical Manual

The Contractor **shall**(1) deliver a SNC and a NRS System Technical Manual documents

(STMs) (see CDRL A011) that reference the executable software, source files, and software support information, including build design information and compilation, and modification procedures for a CSCI. The Contractor **shall**[(2)] provide appropriate update pages to the SNC and NRS system level technical manuals according to SNC and NRS implemented changes.

5.1.1.4 Link 22 Guidebook

During the early NILE ISS Phase a Link 22 Guidebook (CDRL A011) has been issued. It includes both high-level and detailed descriptions of all components of the Link 22 system and their modes of operation and key features. This guidebook provides suitable information for Link 22 operators, planners, managers, developers, and testers. The intent of the document is to provide both an introduction for new users, as well as a detailed reference for established users. The Link 22 Guidebook **shall**[(1)] be released in .pdf format in three different versions that have specific distribution procedures:

a. "LINK 22 GUIDEBOOK" (COMPLETE GUIDEBOOK); for NILE Nations, their approved contractors / industry suppliers & Contributing 3PS Nations only;
b. "LINK 22 GUIDEBOOK - OVERVIEW AND OPERATIONS" (it includes Chapters 1 & 2, Appendices A, B, E, F & G, and the Index); for NILE Nations, their approved contractors/industry suppliers, Contributing 3PS Nations and approved 3PS Nations only;
c. "LINK 22 GUIDEBOOK - OVERVIEW" (it includes Chapter 1 and Appendices A, E, F & G); for the public domain.

The Contractor **shall**[(2)] provide configuration control upon the Link 22 Guidebook in the same manner required for documents listed in Appendix D - Paragraph 2.1.

5.1.1.5 Contractor Conducted Test and Evaluation

5.1.1.5.1 Test and Evaluation Program

Software testing **shall**[(1)] be conducted by the Contractor in following the guidance of standard IEEE/EIA 12207 as specified in Paragraph 4.4. The Contractor **shall**[(2)] deliver two Software Test Description (STD) documents: one each for the SNC and NRS (CDRLs A007 and A012). The STDs **shall**[(3)] encompass both CSCI and System Qualification Testing. Existing CSCI and System Qualifications tests, which are reused, will be incorporated into the revised STDs. The Contractor **shall**[(4)] conduct a sequence of testing that follows the testing phases of Computer Software Unit (CSU) testing, CSCI Integration testing, System Integration testing, and System Qualification testing and **shall**[(5)] deliver two Software Test Report (STR) documents: one for the SNC and one for the NRS (CDRL A008 and A013).

5.1.1.5.2 General Rules for Testing

The following general rules **shall**[1] apply for all formal verification activities:

a. All Contractor conducted testing **shall**[2] be performed following Government approved plans and procedures (STDs). Unlike CSCI and System Qualification Test (SQT) phases, where the Government is witnessing all test activities, test witnessing by Government representatives is not required during CSU and Software Integration Test phases, but **shall**[3] be allowed and **shall**[4] be at the discretion of the Government, who **shall**[5] be notified of testing dates at least 30 calendar days in advance. The Government will notify the Contractor of intent to witness individual tests. The Contractor **shall**[6] notify the Government at least five (5) business days in advance whenever the start of any testing will be delayed and **shall**[7] concurrently notify the Government of the new start date;

b. The Contractor **shall**[8] prepare and submit STRs of testing activity results (CDRLs A008 and A013). Two documents **shall**[9] be delivered ten (10) business days after CSCI Tests: one for the SNC, one for the NRS, noting that the Scenario Generator and Media Simulator CSCIs are incorporated into the NRS. The test reports **shall**[10] include soft copy versions (PDF) of the completed Acceptance Test Procedures. They **shall**[11] provide evidence that the tests were conducted, the results that were obtained, and bear the signatures of the personnel who conducted or witnessed the tests;

c. The Contractor **shall**[12] conduct retests of previously completed testing for which correction of a deficiency or any other modification affects the results of those previously completed tests. The selection of requirements for retesting is a joint Contractor and Government decision, with the Government having the final authority.

5.1.1.5.3 Testing Requirements

The Contractor **shall**[1] perform all necessary testing phases including Computer Software Unit (CSU) testing, CSCI Integration testing, System Integration testing, and System Qualification testing to demonstrate to the Government that each individual CSCI and the overall SNC and NRS Systems meet the new requirements derived from the item list in Appendix C and requirement items identified in the course of the contract.

The table below presents the possible sequence of events within a specific development phase. Item (A) represents SNC CSCI and NRS HWCI/CSCIs, while item (B) represents

MLST3 Link 22 related CSCIs, and (I) represents the ISS Contractor.

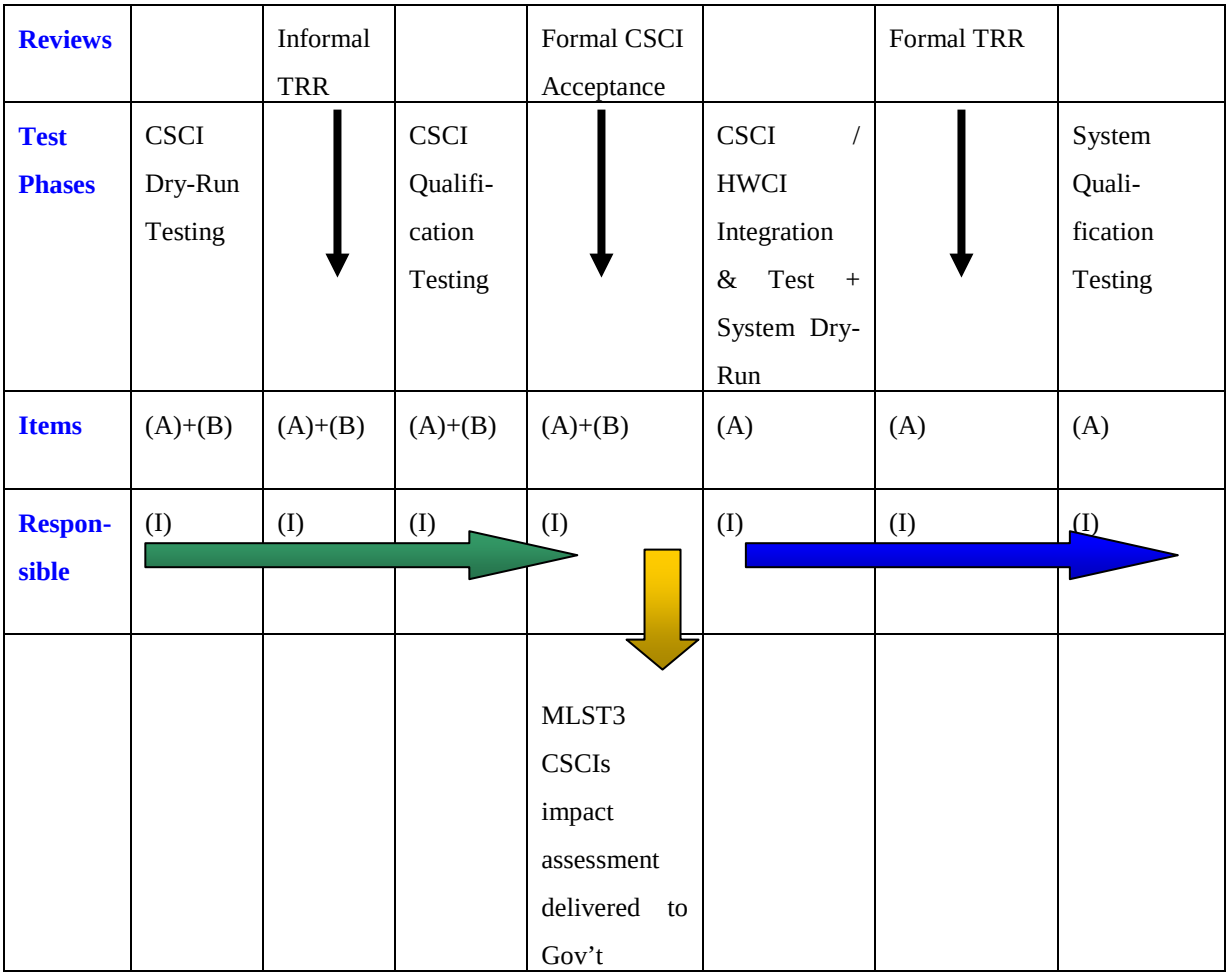


Figure 2: **Test phases with major milestones. Key: Item (A) represents SNC CSCI and NRS HWCI/CSCIs, (B) represents MLST3 Link 22 related CSCIs, and (I) represents the ISS Contractor.**

5.1.1.5.4 Test Readiness Review (TRR)

As specified on a TDL, a TRR may be scheduled, for each Block Cycle release, prior to the conduct of both "formal" CSCI and Systems Qualification Tests (SQT). The Contractor **shall**[(1)] call for a TRR when confident that the amended software, test scenarios and test procedures are complete and ready to be conducted. The purpose of the TRR is for the Contractor to present enough evidence to allow the Government to authorize to proceed to the next phase of testing. The following considerations **shall**[(2)] be addressed:

a. Requirements Issues and Changes;
b. Acceptance (Block Cycle) Test Procedures, and Scenarios;

c. Software Test Resources and Tools;
d. Hardware and Support Environment.
e. Configuration Management and Software Quality Assurance;
f. Test Team;
g. Recommended Tests to Conduct for Formal CSCI/System Testing;
h. Known Software Problems;
i. Test Schedule.

As shown at Paragraph 5.1.1.5.3 – Figure 2, the CSCI TRR **shall**$^{(3)}$ also address the impact on the MLST3 CSCIs (i.e. SNCd, MS). The impact statement **shall**$^{(4)}$ be given by the Contractor to the Government for subsequent forwarding to the MLST3-ISEA for integration into the MLST3. The Contractor **shall**$^{(5)}$ prepare and submit minutes of the TRR (CDRL A005).

5.1.2 ENGINEERING SERVICES

5.1.2.1 Engineering Services for the NILE PMO (CLIN X001)

The Contractor **shall**$^{(1)}$ provide technical/engineering services to the NILE PMO with respect to tasks related to Appendix C Items and Link 22 System Engineering elements.

5.1.2.1.1 Analysis of System Issues and Enhancement Proposals

The Contractor shall provide Subject Matter Expertise to assist the NILE PMO in the resolution of system issued and bug fixes. These services **shall**$^{(2)}$ include:

a. FRs assessment and response: record all incoming FRs and analyze them for technical feasibility, validity, including schedule and cost impacts as specified on a TDL. The Contractor will recommend a resolution;
b. Support on all issues and questions related to the four different media types, including testing and documentation changes;
c. Problem verification, reporting, tracking and resolution, using the PMO designated tools and procedures;
d. Incorporation of hardware and software updates by retrofit.

5.1.2.1.2 Planning and execution of integration and field testing

As specified on a TDL, the Contractor **shall**$^{(1)}$ provide Subject Matter Expertise to assist the NILE PMO in the preparation and execution of test of all the systems which encompass the Link 22 architecture to be held either at Contractor facility or Government sites. These

services **shall**[(2)] include developing Test Plans and Test Procedures (CDRL A003) for assessing conformance and compatibility/interoperability of devices designed by Third Parties for the Link 22 System like Radios, SPCs, COMSEC, DLPs. Conformance means compliance to the relevant specification and suitability in the overall Link 22 system environment while compatibility/interoperability is the condition among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. At test completion the Contractor **shall**[(3)] also provide detailed Test Report (CDRL A003) of the activity performed, and technical analysis and evaluation of the results.

5.1.2.1.2.1 New HF FF Waveforms Validation

The Link 22 system currently supports six different waveforms (WFs) for HF Fixed Frequency (FF) medium. Each WF is identified, within the SNC, by a Media Setting Number (MSN) from 1 to 6. New waveforms might be proposed in replacement or addition to the existing ones by the NILE Nations to enhance HF performances in terms of higher data capacity and extended range. They could differ for modulation scheme and coding scheme as well as preamble structure. This task will consist in testing the entire Link 22 system while implementing new WFs according to a given Validation Plan and in assessing if validation requirements are met, in particular if the system under test:

- Operates as expected and theoretically specified;
- Meets the operational needs.

New WFs might be validated in real environment or NILE validated HF simulated channels. As specified on a TDL, the Contractor **shall**[(1)] execute tests run using operationally relevant scenarios in order to collect validation data. The Contractor **shall**[(2)] provide detailed report and results of the mentioned validation activity (CDRL A003).

5.1.2.1.3 Training

The Contractor **shall** provide tailored training sessions at the Contractor's site to familiarize national participants with the Link 22 system, including system operational aspects, operation and use of the SNC, NRS, supporting ancillary equipment, and documentation.

5.1.2.1.4 MLLC System Integration

As specified on a TDL, the Contractor **shall** be required to support the NILE PMO in assessing the system level aspects of the MLLC development effort, including:

a. Supporting the requirement definition, analysis, prototyping, procurement, integration, and testing of new proposed capabilities or equipment including the MLLC;
b. Providing Continued System-Level Engineering support to NILE PMO during the MLLC FD development. The support may include:
   - Assessments and/or recommendations on the impact/viability of vendor or authority proposals that may affect the System;
   - Answering specific technical questions from the PMO as they review system level CDRLs submitted to PEO C4I for the MLLC FD task. Answers to such questions shall ensure engineering feasibility and implementation to Link 22 system;
   - Generating and delivering a draft MLLC IRS based on the existing LLC IRS and removing description that is no longer appropriate for MLLC based on MLLC requirements. It is noted that exercising optional MLLC FD requirements might lead into SNC/NRS behavior changes requiring software and documentation adjustments.

5.1.2.1.5 Services Provided for International Forums

As specified on a TDL, the Contractor **shall(1)** be required to support the NILE PMO at the following types of International forum, providing subject matter expertise and input on technical issues, arrangements and conduct of:

a. The NILE Configuration Control Board (NILE CCB);
b. The Link 22 Communications and Interoperability Working Group (Link 22 C&IWG);
c. The I/O Testing being conducted between NILE Nations and/or contributing Third Party Nations;
d. Other meetings or workshops on Link 22 or Technical Data Links related matters providing material for easing the update of STANAG 5522 and other standards used for Link 22 system design.

As specified on a TDL, the contractor **shall(2)** provide presentation material and working papers on technical subjects in preparation for the above forums.

5.1.2.1.6 NILE Website

As specified on a TDL, the Contractor **shall(1)** be asked to build up, host and maintain a NILE Project Website, publishing and securing contents identified by the NILE PMO. It **shall(2)** be

designed as a portal to easily allow:

a. Users Management and in particular it shall offer:
   - web access based on the assignment of username and password according to a proper user registration procedure.
   - the capability to inform the NILE PMO of received access requests and provide the capability of granting or denying access to requestors.
   - the capability, for every single access/membership, to assign the user/member to specified users groups.
   - a user management tool which allows deleting users, changing their group assignment and creating new user groups.
   - several e-mail distribution lists. An overall list which contains all registered members' e-mail, as provided in the member's profile, shall be automatically generated. Specific lists based on the user groups which contain the user group members' e-mail as provided in the member's profile shall be also automatically generated.

b. Documents Management and in particular it shall offer:
   - a document repository with different document access rights (full control, read-only, etc.).
   - a function which allows to assign the access rights to user groups and to change existing access rights.
   - the capability of uploading files via the internet, but limited to certain user groups. The portal shall also offer the possibility to inform members via the e-mail distribution lists that a file was uploaded and the possibility that the up loader can choose which e-mail distribution list is to be used.
   - the possibility to download files via the internet, but only if the member is allowed to, based on his access rights.

c. Forum: the portal shall offer capability to create a forum, manageable by the website administrators, along with the possibility to limit the forum accessibility based on the different user groups. The NILE PMO must have the possibility to allow access to the forum either for all members or only for certain user groups. When a new forum topic is created, the portal shall offer the possibility for the allowed forum users to be informed via the e-mail distribution lists.

The NILE PMO will be the only responsible entity for:

a. granting and setting proper user rights;
b. creating and managing forums;
c. authorizing the posting of documents or any other content (i.e. CMIS, meeting

minutes, etc).

5.1.2.1.7 Provision of a NILE Test Environment/Lab

The Contractor **shall**[(1)] provide and maintain test environment suitable for the development and maintenance of the NILE Product. General support, including NRS/SNC Infrastructure and OS Support, will be part of the implementation of the ISP as defined in section 5.1.3.12 of this PWS.

The contractor **shall**[(2)] set-up and maintain of a NILE Lab at the Contractor's site. The Contractor shall ensure availability of the following capabilities:

a. Two operational NRS environments (current and previous BC) shall be maintained for the duration of the contract. Software shall be provided as GFI;
b. An operational MLST3 environment shall be maintained for the duration of the contract. Software shall be provided as GFI;
c. Availability of personnel trained in the operation of the NRS components, SNC, SNCd, interfaces, ancillary equipment (e.g. TOD card) and MLST3.

The Contractor **shall**[(3)] recommend and provide any general purpose and special purpose electronic test equipment required for the operation and maintenance of the SNC and NRS hardware, including GFP items specified in the contract.

The Contractor **shall**[(4)] conduct and on-going analysis of software and hardware obsolescence issues. These issues shall be reported to the Government as they arise.

When new hardware is procured under this contract, the Contractor **shall**[(5)] select only hardware that can be maintained and repaired via service organizations with facilities located in each NILE participating Nation, to the extent such hardware is available. An exception to this applies to the procurement of a commercial development configuration. The Contractor **shall**[(6)] deliver all information about procured or modified hardware to the Government IAW MIL-PFR 49506 specified at paragraph 4.2.

5.1.2.1.8 Software Repository

The Contractor **shall**[(1)] maintain all software files, updates, revisions, and upgrades under configuration control during the period of performance. During this time, the Government retains the right to monitor and review, via the IPT process, all software information maintained by the Contractor. The Contractor **shall**[(2)] provide a final release at formal delivery for all software modified or purchased under this contract.

5.1.2.2 NATION-SPECIFIC Support (CLIN X004)

The Contractor **shall**[(1)] provide technical/engineering services to any requiring NILE Nation with respect to any Link 22 system engineering matter. These services **shall**[(2)] include:

a. Operation of national NRS components, SNC, SNCd, interfaces and ancillary equipment (e.g. TOD card) on Intel based computer platforms;
b. Analysis and evaluation of national SNC and NRS integration test results;
c. Tailored training sessions to familiarize national participants with the Link 22 system, including system operational aspects, operation and use of the SNC, NRS, supporting ancillary equipment, and documentation.

5.1.2.2.1 MLLC Full Development Engineering Support

5.1.2.2.1.1 Background

In February 2011, a contract for the design and development of a new COMSEC device for the Link 22 system was awarded by PEO C4I to the U.S. company SafeNet, Inc. After successful completion of a Proof of Concept (PoC) phase, the subject contract is progressing to the Full Development (FD) phase fully funded by the United States. Given the significant impact that the introduction of the MLLC device could have on the Link 22 system, continuous technical support to the Link 22 MLLC FD phase efforts is required.

5.1.2.2.1.2 Requirement

The Contractor **shall**[(1)] ensure system level integration and compatibility of the proposed MLLC design with the Link 22 system. This support may include:

a. Providing subject matter expertise for Link 22 system and all NILE products (especially the NILE Reference System (NRS);
b. Creating of the MLLC System Test Plan, Test Procedures and Test Reports (CDRL A003);
c. Acting as the Independent Test Agent (ITA) for PMW 130/150, performing all MLLC formal testing based on the MLLC System Test Plan. Tests will be performed at a designated secure laboratory facility using a stand-alone single computer NILE reference System (NRS);
d. Updating the system specifications or I/F documentation that may be required to be modified to accommodate planned performance enhancements;
e. Providing engineering software releases to allow testing of modified and/or new functionality.

The Contractor **shall**[2] also provide access and a manned NILE Lab (at the Contractor's site) to the MLLC FD contractor, during the development, test and acceptance of the MLLC FD task. Requirements will be based on the assumption that the FD effort is planned to be completed within 2015/2016 timeframe.

5.1.3 PROJECT MANAGEMENT SERVICES (CLIN X001)

5.1.3.1 Project Structure

The Contractor **shall**[1] establish and maintain an effective project management structure to oversee execution of tasks directed by this PWS. The Contractor **shall**[2] designate a single project manager who **shall**[3] have overall responsibility for control and coordination of all work performed. This manager **shall**[4] act as the single focal point within the Contractor's activity for all required project status information. An open channel of communication (hotline), both via phone and email, **shall**[5] be provided by the Contractor during PMO working hours. The Contractor **shall**[6] be aware of the need to maintain current knowledge to support the system engineering tasks. The Contractor **shall**[7] provide identification of issues and problems with the specifications, implementations and overall Link 22 system to enable the Government to achieve efficient, effective and interoperable Link 22 systems.

5.1.3.2 Project Planning and Control

The Contractor **shall**[1] identify, plan, organize, direct, coordinate, and control activities necessary to accomplish overall contract requirements. The Contractor **shall**[2] establish a formal organization responsible for accomplishing the tasks outlined in this PWS. The Contractor **shall**[3] ensure that all plans and procedures required by this PWS and CDRLs approved by the Government, are adhered to by the Contractor and sub-contractors, if any. A clear line of project authority **shall**[4] exist between all organizational elements and the project manager. Each PWS task **shall**[5] be identified against one or more positions or elements within the Contractor's (to include sub-contractors) organization that **shall**[6] perform the corresponding work. The Contractor **shall**[7] appoint personnel who have management and task accomplishment responsibility, including the sub-contractors' key personnel, to ensure expeditious transfer of appropriate technical data among sub-contractors and associate contractors.

The Contractor **shall**[8] document, in a tailored Program Management Plan (PMP) (CDRL A001), management (and associated organizational chart), cost, engineering, logistics, and software development plans. This single document **shall**[9] include a CWBS which represents

how the Contractor plans to accomplish the entire contract work scope, consistent with the Contractor's internal organizations and processes. The CWBS will serve as the framework for contract planning, budgeting, and reporting of cost and schedule status to the Government (see following paragraph).

The Contractor **shall**[(11)] identify and implement internal procedures/organization necessary to ensure internal coordination for the activities that are part of this contract. The Contractor **shall**[(12)] identify a single authority who will interface with the NILE PMO and, as directed by and under control of the NILE PMO, with the other entities participating to the NILE ISS phase including:

a. The Governmental Configuration Management forums (CCB, etc.);
b. The Governmental entity responsible for implementing MLST3 system evolution (i.e. SSC Pacific Code 591);
c. NATO and NILE working groups;
d. National NILE segments integrators, as contracted by the NILE Nations, when required.

5.1.3.3 Monthly Status Report (MSR)

The Contractor **shall**[(1)] provide, on monthly basis, a report (CDRL A002) detailing the schedule of events and the integrated cost and schedule status of work progress on the contract. The report **shall**[(2)] be prepared for planning work, controlling costs, and generating timely, reliable and valuable information for the PMO controlling the overall NILE Project. Supporting schedules detailing the sub-events required to achieve milestones in the schedule **shall**[(3)] also be prepared and maintained. Changes to the schedule **shall**[(4)] be highlighted, with reasons for the changes. The Contractor **shall**[(5)] address the effect of the changes on interrelated milestones. The Contractor **shall**[(6)] also relate technical accomplishment with cost and schedule accomplishment. The MSR **shall**[(7)] be also briefed and discussed at any In-Process Reviews (IPRs).

5.1.3.4 Electronic Data Bases and Management Tools

The Contractor **shall**[(1)] manage data generated as part of the contract in data bases or with specific data management tools. Data **shall**[(2)] be maintained in the following formats: Microsoft WORD for text and tables, Microsoft ACCESS for databases, Microsoft EXCEL for spreadsheets, Microsoft PROJECT for project schedules and Microsoft POWERPOINT for presentations. The use of PDF format is also allowed.

5.1.3.5 Project Reviews

Use of video teleconferencing (VTC) facilities **shall**[(1)] be required, should the geographical distance between the Government and Contractor's sites make face to face meetings inefficient in terms of time and travel. The Contractor **shall**[(2)] describe its VTC facilities to the Government, and the Government will determine the method of conducting each specific meeting.

5.1.3.6 Post Award Conference

The Contractor **shall**[(1)] host a Post Award Conference no later than one (1) month after contract award. The Government will establish specific dates in coordination with the Contractor. The agenda **shall**[(2)] be developed by the Contractor and **shall**[(3)] include the following:

a. Introduction and identification of key Government and Contractor management and engineering personnel;
b. The Contractor's management organization, plans, procedures, and schedules;
c. The Government's management organization, plans, procedures, and schedules;
d. Government concerns;
e. Contractor concerns;
f. Status of GFE/GFI;
g. Status of submittals and approvals of regulatory issues, i.e. export, security;
h. Status of subcontracts, if any;
i. Other tasks established by the Government in conjunction with the Contractor.

The Contractor **shall**[(4)] prepare and submit minutes of the Post Award Conference (CDRL A005).

5.1.3.7 In-Process Review (IPR)

Commencing with the Post Award Conference at the Contractor's site, the Contractor **shall**[(1)] conduct IPRs. The Contractor **shall**[(2)] present and administratively support IPRs. All IPRs **shall**[(3)] be held at the Contractor's facility except as otherwise directed by the Government. Use of VTC facilities **shall**[(4)] be required, should the geographical distance between the Government and Contractor's sites make face to face meetings inefficient in terms of time and travel. A IPR **shall**[(5)] be performed quarterly but a higher frequency, especially in the first contract year, might be determined by the Government on the basis of the Project issues and the volume of tasks to be performed. The Contractor **shall**[(6)] develop agendas and minutes for the IPR (CDRL A005). The Government will have the right to modify or add

items to the IPR agenda. At the IPR, the Contractor **shall**(7) determine and report detailed project status information, keyed to the CWBS, CDRLs, and CLINs, including proposed sub-contractor work. The Contractor **shall**(8) prepare and submit minutes of each IPR (CDRL A005).

5.1.3.8 Integrated Product Team (IPT)

The Contractor **shall**(1) establish and participate in joint, regularly scheduled not more than monthly, Contractor/Government IPT meetings between the Contractor and the NILE PMO to resolve problems and issues. IPT responsibilities **shall**(2) include:

a. Monitoring of the accomplishment of project work and progress using information from all available sources, including cost and schedule data;
b. Identification of technical and project risks, and formulation of risk mitigation recommendations;
c. Expediting resolution of problems and clarifying issues.

The IPT **shall**(3) communicate the status of their activities to the project managers and raise critical issues for discussion at the IPR. The IPT meetings will be held either at the Contractor's facility or via VTC, except as otherwise directed by the Government, and organized on the case-by-case basis, according to the volume of items to perform and problems to resolve. The Contractor **shall**(4) prepare and submit minutes of the IPT meeting (CDRL A005).

5.1.3.9 Risk Management

The Contractor **shall**(1) establish a risk management program that identifies and controls performance, cost, and schedule risks likely to occur in this effort. Planning for risk management **shall**(2) be documented in the PMP (CDRL A001).

5.1.3.10 Security Management

All work performed under this PWS **shall**(1) be performed in accordance with the DD Form 254. Performance of this task by the Contractor **shall**(2) require access up to, and including, NATO SECRET. The contractor **shall**(3) attend meetings classified up to the NATO SECRET level.

Note: In the case the awarded Contractor is an United States entity, if foreign travel is required, all outgoing Country/Theater clearance message requests **shall**(4) be submitted to the SSC SD foreign travel team, OTC2, Room 1656 for action. A Request for Foreign Travel

form **shall**[5] be submitted for each traveler to initiate the release of a clearance message at least 35 days in advance of departure. Each traveler **shall**[6] also submit a Personal Protection Plan and **shall**[7] attend a Level 1 Antiterrorism/Force Protection briefing within one year of departure, and a country specific briefing within 90 days of departure.

5.1.3.10.1 Classified Technical Data

The Contractor **shall**[1] identify and implement the appropriate organizational procedures necessary to maintain the NATO SECRET classification level during modification and testing of particular system requirements (i.e., UHF EPM medium parameters). These procedures **shall**[2] be established and submitted to the designated security authorities for approval. Coding, integration, and testing activities **shall**[3] be organized in a way to minimize the use of classified parameters.

5.1.3.10.2 COMSEC equipment

The Contractor **shall**[1] manage the use and storage of the Link 22 COMSEC devices, fill devices, and key materials in accordance with established procedures for handling COMSEC material. Non-US Contractors use and storage of this equipment **shall**[2] be in accordance with the bilateral agreement between the Contractor's own Government and the US Government. Facilities used for modification and testing of the SNC and NRS **shall**[3] possess the proper accreditation prior to storage and processing of classified data.
Installation of COMSEC equipment **shall**[4] be performed in accordance with the requirements of AMSG 719.

5.1.3.11 Configuration Management (CM)

This section details the Configuration Management requirements for this contract. The term "Configuration Baseline" refers to all the initial baseline software, hardware and documentation as defined in Appendix D, and any evolution of these items through the life of this contract. Amendment of the current NILE baseline software, hardware and documentation **shall**[1] be handled in accordance with the NILE approved CM process reported in the NILE ISS phase Configuration Management Plan (CMP).
This document also integrates and expands CM terms and definitions mentioned in this PWS and provides approved format and template of NILE Feedback Reports (FRs).

5.1.3.11.1 Configuration Management Plan (CMP)

The Contractor **shall**[1] develop a CMP as part of the PMP (CDRL A001) incorporating the

requirements of the existing NILE CM procedures as contained in the NILE ISS phase CMP.

5.1.3.11.2 Configuration Baseline

The Contractor **shall**[(1)] be responsible for incorporating changes in the PMP and maintaining the configuration baseline, identified in Appendix D, to accurately document the evolving configuration until the end of the contract. The Government will be responsible for approval of all updates to the configuration baselines. A new baseline **shall**[(2)] be released by the Contractor after completion of each Block Cycle Update.

5.1.3.11.3 Configuration Control

The configuration control process **shall**[(1)] encompass the following:

5.1.3.11.3.1 Configuration Management Information System (CMIS)

The contractor **shall**[(1)] implement and maintain a CMIS (CDRL A004) to file project information. The CMIS **shall**[(2)] be capable of producing Microsoft ACCESS compatible output and **shall**[(3)] be continuously available to the Government.
The Contractor will be provided a copy of the existing CMIS (CDRL A004). If the Contractor chooses to implement a new CMIS, the contractor will have to migrate all historical data to the new database.

5.1.3.11.3.2 Configuration Boards

5.1.3.11.3.2.1 Configuration Control Review Board (CCRB)

The Contractor **shall**[(1)] participate on the CCRB (a Government/Contractor forum chaired by the Government) to monitor the status and disposition of NILE software and hardware problems and pending Change Proposals (CPs). The CCRB will review and prioritize CPs, Problem Change Reports (PCRs), and Feedback Reports (FRs), Support Tasks and establish consensus on feasible approaches to problem corrections(s), including the implementation of corrections. The Contractor **shall**[(2)] generate an Engineering Change Proposal (ECP/CP) for any pending modification item or PCR according to the decision taken during the CCRB. CCRBs **shall**[(3)] be held at the Contractor's facility or via email, phone conference, or VTC, as necessary and agreed upon with the Government on a case by case basis. Further details on CCRB structure and management of the processes are provided in the NILE ISS Phase CMP.
An agenda **shall**[(4)] be developed by the Contractor prior to each CCRB meeting (CDRL A005). The Contractor **shall**[(5)] prepare and submit minutes of the CCRB meetings (CDRL

A005). A collection of all technical documentation such as PCRs, CPs, FRs and WPs **shall**[6] also be provided (CDRL A006).

5.1.3.11.3.2.2 Configuration Control Board (CCB)

The CCB is a configuration control function for the nations. The Contractor will be invited to attend this board if clarifications on technical aspects should be necessary.

5.1.3.12 Integrated Support Plan (ISP)

The Contractor **shall**[1] develop, implement and maintain an ISP as part of the PMP (CDRL A001). This effort **shall**[2] be conducted as an integral part of the modification process as per section 5.1, with the intent of minimizing products life cycle costs and enhancing supportability.

5.1.3.12.1 Maintenance Concept

The ISP plan shall detail the maintenance concept for NILE lab, specifying items to be supported and where Organizational level (In house) or Depot level (suppliers) will be used. Organizational level repair **shall**[1] be limited to replacement of modules such as circuit cards, power supplies, CRT screens, keyboards or parts, etc., while Depot level repair **shall**[2] consist of repairing piece parts of these modules.

5.1.3.12.2 Packaging, Handling, Storage, and Transportation (PHS&T)

The Contractor **shall**[1] establish PHS&T procedures that provide for safe and efficient packaging, handling, storage, movement, and protection of the hardware and software items. All activities, milestones, and planning **shall**[2] be addressed in the ISP portion of the PMP (CDRL A001).

5.1.3.12.3 System Safety

The Contractor **shall**[1] establish and implement a System Safety Program IAW MIL-STD-882D as specified in Paragraph 4.2. The Contractor **shall**[2] ensure that all safety warnings and cautions required to protect personnel and permit proper system operation and maintenance of the NRS are included in the appropriate locations of all equipment and technical manuals, in accordance with Section 4 of MIL-STD-882D.

5.1.3.13 Quality Assurance (QA)

5.1.3.13.1 Quality Assurance Program

The Contractor **shall**[(1)] implement a QA program adapted to the volume of items, following the guidance of ISO 9001 specified at Paragraph 4.5. The Contractor **shall**[(2)] apply the company's quality standard(s) and specification(s) to:

a. Internal management processes;
b. Ensuring that best commercial practices and policies are in place and there is capability to audit that these practices and policies are being followed;
c. SNC and NRS baseline specifications compliance and requests for waivers or deviations;
d. SNC and NRS software upgrade;
e. Analysis and design documentation;
f. Block Cycle test plans, procedures and reports;
g. Process improvement.

At project reviews (IPRs), the Contractor **shall**[(3)] demonstrate in detail how benchmarks and metrics are established and controlled to ensure repeatable results and internal QA processes meet all applicable Government requirements stated elsewhere in this contract.

The QA program **shall**[(4)] be documented, and all records associated with the establishment, implementation, and operation of the quality system made available for review and retention. The Contractor **shall**[(5)] monitor the preparation, maintenance and compliance with work and inspection instructions as a function of the quality program. The Government may perform any necessary inspections, verifications, and evaluations to ascertain conformance to requirements and the adequacy of the implementing procedures. Inspection and test records **shall**[(6)] indicate the nature of the observations, number of the observations made and the number and type of deficiencies found. Data included in inspection and test records **shall**[(7)] be complete and accurate, and **shall**[(8)] be used for trend analysis and to assess corrective action effectiveness.

5.1.3.13.2 Quality Audits

Quality audits will be performed to verify implementation of the Contractor's QA program. For software modified under this contract, the Contractor **shall**[(1)] conduct Software Quality Audits (SQAs) of Contractor compliance to the Government's requirements. Software Quality Audits (SQA) **shall**[(2)] not exceed one (1) day. For planning purposes, at least two (2) SQAs **shall**[(3)] be performed per modified CSCI per Block Cycle update. The Contractor **shall**[(4)] provide pertinent managerial and technical skills necessary to support SQAs and

CSCI surveillance. SQAs **shall**[(5)] be conducted by the Contractor in accordance with a Government approved company standard audit plan. The Contractor **shall**[(6)] correct any deficiencies discovered during the audit(s). For each SQA conducted, the Contractor **shall**[(7)] submit an Audit Summary Report to the Government (CDRL A005).

5.2 OTHER DIRECT COSTS (CLIN X002/X005)

5.2.1 Materials

In the performance of CLINs X001/X004, it may become necessary for the contractor to acquire limited quantities of hardware, software or firmware. Such items shall be requested in accordance with paragraph 5.2.3 below and maintained in accordance the GFP clauses in the contract.

5.2.2 Travel

In order to support contract activities, up to two contractor personnel may be required to travel to attend in-person meetings or to provide remote engineering/training support services on Link 22 related matters. Major meetings which may require contractor attendance are scheduled twice a year for the mean length of a business week each (typically to be held abroad in May and November), however additional travel might be required at short notice. The Contractor may also be required to take local trips in support of one or more requirements described at paragraph 5.1.2. The costs for travel, subsistence, and lodging shall be reimbursed to the Contractor in accordance with the Federal Acquisition Regulations.

5.2.3 Procedures for advance approval of Other Direct Costs (ODC)

Any travel or contractor acquired property under this contract must be specifically requested in writing by the contractor at least two weeks prior to incurring any costs. Written Government authorization will be provided by the Contracting Officer's Representative (COR).

5.3 DATA – CDRLs (CLIN X003) (NSP)

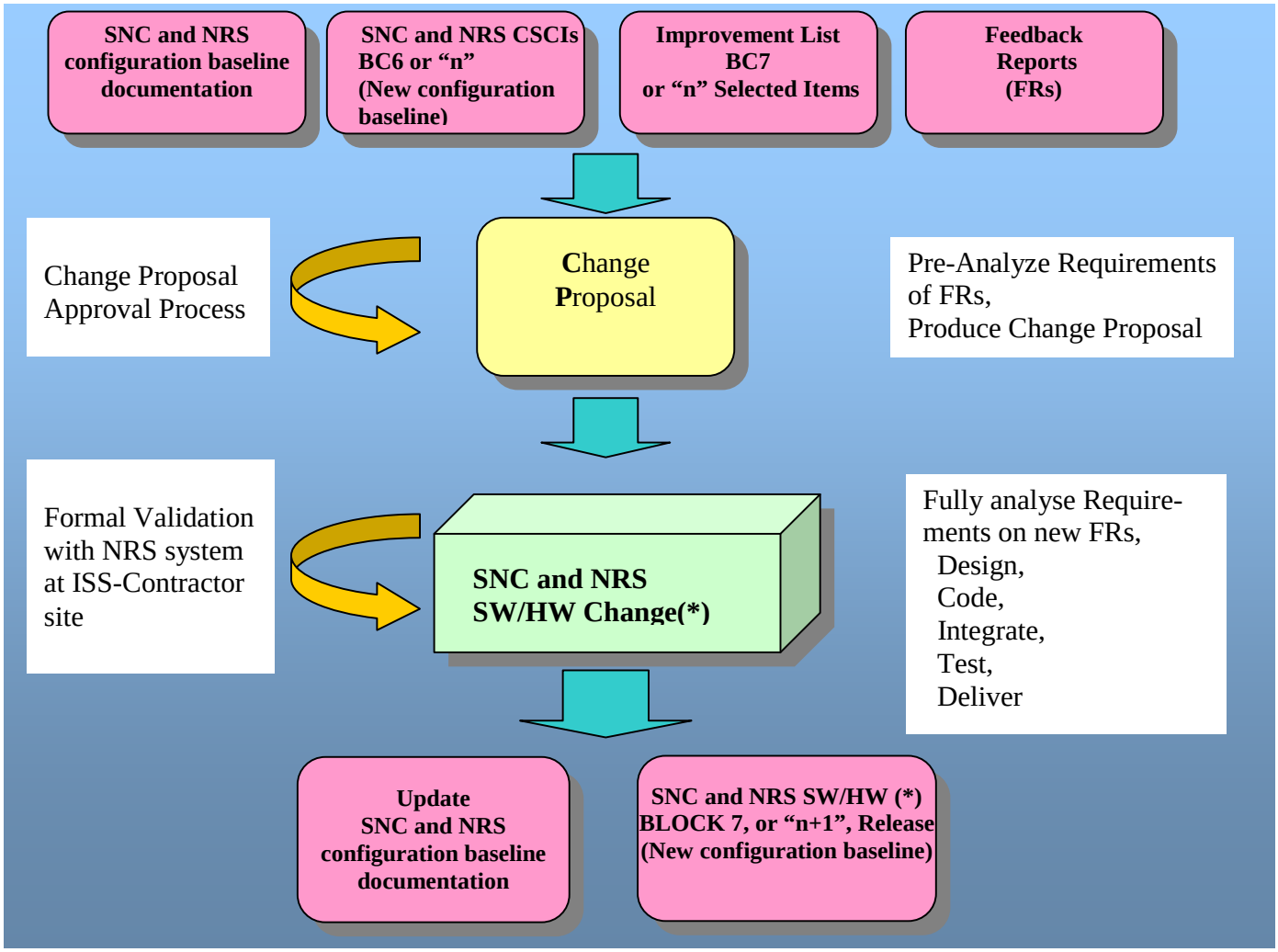
The Contractor **shall**[(1)] deliver the following items when properly directed by TDL:

CDRL	Title
A001	Program Management Plan (PMP)
A002	Monthly Status Report (MSR)

A003	Test Plans/Procedures/Report for Link 22 System devices
A004	CMIS
A005	Meetings Agendas and Minutes
A006	Tech documentation (WPs, CPs, PCRs, FRs, etc.)
A007	SNC Software Test Description (STD)
A008	SNC Software Test Report (STR)
A009	SNC Software Version Description (SVD)
A010	SNC Source and Executable SW (SES)
A011	SNC/NRS Tech Data Package (TDP) including STMs and L22 Guidebook
A012	NRS Software Test Description (STD)
A013	NRS Software Test Report (STR)
A014	NRS Software Version Description (SVD)
A015	NRS Source and Executable SW (SES)

Inspection and acceptance of technical data will also be performed in accordance with a Government QASP (Quality Assurance and Surveillance Plan).

APPENDIX A - SOFTWARE MODIFICATION PROCESS – BLOCK CYCLE 7 AND FOLLOW



App A - Figure 1 Software Modification Process

APPENDIX B - LIST OF ACRONYMS

ARO	At Reception of Order (Contract Award)
ATP	Acceptance Test Procedures
CAGE	Contractor And Government Entity
CCB	Configuration Control Board
CCRB	Configuration Control Review Board
CDRL	Contract Data Requirements List
CLIN	Contract Line Item Number
CM	Configuration Management
CMP	Configuration Management Plan
COMSEC	Communications Security
COTS	Commercial-Off-The-Shelf
CP	Change Proposal
CPU	Central Processing Unit
CRM	Cross Reference Matrix
C&S	Control and Status
CSA	Configuration Status Accounting
CSCI	Computer Software Configuration Item
CSU	Computer Software Unit
CWBS	Contract Work Breakdown Structure
D&D	Design and Development
DERD	Data Extraction and Reduction Document
DID	Data Item Description
DLP	Data Link Processor
DR	Design Review
ECP	Engineering Change Proposal
ELIN	Exhibit Line Item Number
FR	Feedback Report
GFE	Government Furnished Equipment
GFI	Government Furnished Information
GFM	Government Furnished Material
GFP	Government Furnished Property
GPETE	General Purpose Electronic Test Equipment

HWCI	Hardware Configuration Item
IDD	Interface Design Description
ILS	Integrated Logistics Support
ILSMT	ILS Management Team
IPR	In Progress Review
IPT	Integrated Product Team
IRS	Interface Requirement Specification
ISS	In-Service Support
LLC	Link-Level COMSEC
MLLC	Modernized Link-Level COMSEC
MLST3	Multi-Link System Test and Training Tool
MS	Media Simulator
MSR	Monthly Status Report
NILE	NATO Improved Link Eleven
NRS	NILE Reference System
NRSSS	NRS System Specification
NU	NILE Unit
PCR	Problem / Change Report
PHS&T	Packaging, Handling, Storage, and Transportation
PMP	Program Management Plan
PR	Problem Report
PTDB	Problem Tracking Data Base
PWS	Performance Work Statement
QA	Quality Assurance
R&M	Reliability and Maintainability
SDP	Software Development Plan
SG	Scenario Generator
SNC	System Network Controller
SNCd	System Network Controller Diamond
SNCSS	SNC Segment Specification
SOW	Statement Of Work
SPC	Signal Processing Controller
SRS	Software Requirement Specification

SRR	System Requirements Review
SQT	Software Qualification Test
STD	Software Test Description
TDL	Technical Direction Letter
TDP	Technical Data Package
TDS	Tactical Data System
WBS	Work Breakdown Structure
WP	White Paper

APPENDIX C - Work Package Description

For any of the following tasks, the contractor **shall**[(1)], as a minimum, perform the following:

a. Utilize existing scenarios, or updated scenarios, with modified existing code to demonstrate effects, with corresponding feedback into the design and solution evaluation process.
b. Demonstrate the impact of requirements, including those on other protocols, including rationale.
c. Analysis **shall**[(2)] be quantitative with a defined demonstration method.
d. Analysis **shall**[(3)] use assessment criteria including latency, reliability, end-to-end delay and bandwidth utilization.
e. Analysis **shall**[(4)] include backward compatibility analysis on existing NILE interfaces and CSCIs.
f. Results of analysis **shall**[(5)] be provided in a paper (WP or PCR).

The Government will provide a definition of task items for analysis, design and implementation during each Block Cycle through a proper TDL.

1 PROBLEM CHANGE REPORTS (PCRs) AND ANY ADDITIONAL PROBLEM REPORTS

The purpose of this task is to cover the analysis and implementation of PCRs which may be raised from the conduct of modifications necessary to support the items below and any other identified during internal testing or national implementations.

1.1 Problem description

PCRs may be raised as an output from NILE CSCIs modifications, or in support of MLST3 modifications, or possibly as feedback received from national Link 22 implementations. Where applicable, the Contractor **shall**[(1)] generate PCRs and provide analysis showing whether or not they are part of a modification item. A PCR is not considered a part of a modification item when it is due to existing defects in code areas that have been uncovered by the item. If the PCR is part of the modification item, the Contractor **shall**[(2)] analyze, design, implement and test the solution as described in the

PCR. When not part of the modification item (but existing defects in other code areas that have been uncovered by the item), the Contractor **shall**(3) successively analyze and design, and then, pending approval of the CCRB, implement and test a solution as described in the PCR.
The number of expected independent PCRs (not part of listed items) is estimated as ten per year, requiring an average of 150 hours per PCR (1500 hours total).

2. ITEM #01 (FORMERLY REGISTERED AS #90) – NRS EXPANSION TO USE 6 UUTS

2.1 Problem description

The NRS currently supports five Units Under Test (UUT) when in Multiple UUT (MUUT) mode. The original system had a sixth remote UUT capability which was discontinued, which means that the software was designed with the capacity to handle six UUT. The Media Simulator version used for MLST3 can use all six UUTs, utilizing the spare channel that was originally used for the remote UUT. This task would be to modify the NRS so that in MUUT mode it can use all six available UUTs.
An example of the benefits of having more UUTs available is shown by considering the testing done with the three manufacturers SPCs. Due to the 5 UUT limit the scenario had to be run three times, once for each transmitting SPC. If six UUT had been available, a single scenario could have been used to test all three at once.
In SNC Verification mode (only 1 UUT) the use of simulated NUs has limitations in the area of LNE. The Media Simulator has limitations on its capabilities with simulated NUs and the ability to have more UUTs would allow more complex LNE scenarios with multiple LNE units. The analysis could also consider what changes would be needed to implement more than six UUTs.

2.2 Requirement

The Contractor **shall**(1) analyze, implement and document a solution to the problem described in paragraph 2.1 above.

3. ITEM #02 (FORMERLY REGISTERED AS #84) – OLM CHECKSUM IMPLEMENTATION

3.1 Problem description

In a former NILE ISS FO contract, Item 52 (SN Directory Checksum Usage) was

analyzed and a respective White Paper was generated. In addition to the original scope, the WP stated the following:

*"**6.3 RECOMMENDATIONS NOT WITHIN THE SCOPE OF THIS ITEM***

The possibility of having a checksum for the complete Link 22 part of the OLM or for just the SN Directory part was discussed in the analysis for completeness; however this is not within the scope of this Item. If in the future the OLM provides an SN Directory checksum then we would recommend that a future task should be considered to modify the DLP-SNC Interface to pass the checksum into the SNC, and to implement within the SNC the same algorithm used by the OLM generation, thereby allowing the SNC to validate the SN Directory it has received against the checksum."

This task has been generated to implement this option and will include the following:

- Define an algorithm to calculate a checksum on the Link 22 OLM entries
- Define changes to the OLM message specification
- Define the change to the DLP-SNC interface to provide the checksum to the SNC
- Analyze how to modify SG to either have the checksum scripted (needed for negative testing) or to calculate the checksum for a scenario (default), and to provide the checksum to the SNC
- Analyze how to allow the DLP to request the OLM checksum from the SNC
- Analyze how to modify the SNC to calculate the checksum from the OLM version of the SN Directory using the algorithm and compare it against the supplied checksum value. If these values are not the same, inform the DLP and reset SNC Initialization.

The implementation of this task would reduce initialization errors and improve the detection of inconsistencies.

3.2 Requirement

The Contractor **shall**[(1)] analyze, implement, and document a solution to the problem described in paragraph 3.1 above.

4. ITEM #03 (FORMERLY REGISTERED AS #80) – LNE NCS TIMESLOT SIZE CALCULATION ANALYSIS

4.1 Problem description

During testing using a new LNE scenario a constraint error was found in the error log file, caused by attempting to process a timeslot with an invalid length. This was raised as PCR #73, and the recommendation was to fix it by adding checks to stop processing of timeslots with an incorrect length. This was agreed and implemented, which stopped the errors from occurring.

Additionally, the PCR recommended that a future task should analyze the LNE NCS generation design to determine why the invalid length timeslots were being produced and to determine if anything should be done to improve the algorithm.

An incorrectly formed ONCS may increase the time for the LNE process to complete or force the process to fail. This is less likely to happen with Inactive Join LNE, but it may have greater impact in the case of Silent Join LNE.

Any changes to the algorithm would be purely internal to the SNC and would have no impact on backward compatibility.

4.2 Requirement

The Contractor **shall**[(1)] analyze, implement and document a solution to the problem described in paragraph 4.1 above.

4.3 Reference Material

Problem/Change Report #73 (see paragraph 4.3 of the main body).

5. ITEM #04 – EXTENSION OF RE-TRANSMISSION TO DLP TSRs

5.1 Problem description

In a former NILE ISS FO contract, as an outcome of Item 40 (Network Management re-transmission), an extension of the SNC protocols to allow the retransmissions of technical messages was implemented. This mechanism could be extended to allow any DLP to require automatic retransmission of tactical messages in order to extend reliability or important messages. This functionality would be required for the implementation of bulk data transfer and could improve the use of FJ28.0 or J16.0 messages.

5.2 Requirement

The Contractor **shall**[(1)] analyze, implement and document a solution to the problem described in paragraph 5.1 above.

5.3 Reference Material

White Paper for Item #40 (see paragraph 4.3 of the main body).

6. ITEM #05 – SIMPLE PROTOCOL IMPLEMENTATION IN THE SNC AND NRS

6.1 Problem description

Currently the STANAG 5602 ed. 3 SIMPLE protocol to connect NUs, which may be geographically separated, only supports the testing of tactical messages between DLPs. Extensions shall be considered to enable the testing of not just tactical communication between units, but also the ability to test Network management. The Contractor shall execute a study to be conducted in two parts.

Part 1 of the study: The Contractor shall address the implications of extending the SIMPLE protocol to including Link 22 Network Management. This shall include:

- Proposing an amendment to the current Link 22 SIMPLE message standard (STANAG 5602) to support Network Management capabilities
- Assessing the resultant impact on implementation of SIMPLE within the SNC/NRS (as per Part 2 of the Study)

Analysis shall consider the need for simulating: the throughput, media delay and the ability of units to actively acknowledge protocols, both at the tactical and Network Management levels.

Part 2 of the study: The Contractor shall examine alternative methods for implementation of SIMPLE including:

- Implementation in the SNC or
- Implementation using components of the NRS.

Part 2 of the study shall consider the implementation of the extant SIMPLE protocol only which limits the capability to transmission and testing of tactical (F/FJ) messages between DLPs.

6.2 Requirement

The Contractor **shall**[(1)] analyze, document, and propose solutions to the problems

described in paragraph 6.1 above.

7. ITEM #06 – RECORD SIMPLE IN THE SG DX

7.1 Problem description

I/O Testing effort may need Data Recording and Reduction. This item will require the provision of a common tool for Data Recording and Reduction by enhancing the SG DX to include a capability to record tactical data in the SIMPLE format. This will enable the recording of the SIMPLE messages within the Link 22 data extraction file, so that they can be post processed relative to the existing extracted information. The possible changes to all NRS components would be defined, dependent on the functionality of the processing envisioned. The analysis shall include the ability to actively or passively record multiple DLP acting as UUTs, possibly extending the current number of five UUTs that NRS DX currently supports. This task shall consider any overlapping functionality already implemented in other nationally supported tools, such as MLST3.

7.2 Requirement

The Contractor **shall**[(1)] analyze, implement, and document a solution to the problem described in paragraph 7.1 above.

8. ITEM #07 – NETWORK MONITORING AND MANAGEMENT DECISION SUPPORT/AUTOMATION

8.1 Problem description

This item requires improvement of the decision support and configurable automation for the network management of Link 22. The Contractor shall examine currently available information, and define what additional information would be required to be able to make decisions about network management. Where that information is available or how to calculate it, and how this information could be provided to the network management units (NMU, SNMU and their standbys) shall be part of the analysis. The calculations may include what data would need to be collected and how to generate the necessary information from that data.

The goal of the analysis is to define capabilities to reduce the operator load by providing default (standard) behavior to given situations that the operator can simply agree with or can be set so that they are automatically performed. This would allow the network management operator to decide (based on the current tactical situation) whether the network or system could manage itself, without operator intervention. The operator

would be able to set the thresholds used to trigger decisions, allowing the operator to tailor the behavior of the decision support and to define which decisions are performed automatically.

The analysis may include the following aspects:

- Connectivity and propagation conditions
- Frequency Management
- Automated monitoring, control and configuration

The analysis will include the management of the following:

- Media Parameters
- Capacity Allocation (ONCS)
- Network Membership

These equate to the following Network Management orders:

- Media Parameter Management
    - Re-Initialization
- Capacity Allocation Management
    - Reconfiguration
- Network Membership Management
    - Leave Network
    - Join Existing Network
    - Initialize New Network

This item shall include the following suggested sub-tasks:

ITEM #07 / SUBTASK 1 - REAL TIME ASSESSMENT OF OPTIMUM NETWORK CONNECTIVITY

HF channel performance can vary heavily during daily usage. The optional use of an Automatic Link Establishment (ALE) protocol or another technique of frequency performance measurement, considering both Media Setting Number (MSN) and Frequency, could improve the overall system performance. The RF analysis must take care of all the links of the network and make a decision to change for the best frequency only if the whole network will get better performance. The task shall include the development of a metric(s) and algorithm for quantifying and comparing network connectivity to determine optimum network connectivity, bandwidth and stability. The solution shall consider both Frequency and Media Setting Number (MSN).

ITEM #07 / SUBTASK 2 - NETWORK CONFIGURATION ANALYSIS AND

OPTIMIZATION

The Contractor shall develop a capability that allows the SNC to monitor and analyze network behavior and platform configurations (Link 22 Networks and available radios) in real time and recommend to the operator proposals to fix issues (e.g. congestion) or enhance network performance. For example, the SNC could recommend that a unit uses a spare radio to enter another NILE network to resolve a connectivity issue.

This capability should enable a unit to report to its SNC how many and what kind of potential radio capabilities are available, so that the SNC of a NU (local), the SNC of a NMU (remote/Network Manager) or the SNC of a SNMU (remote/Super Network Manager) can automatically propose to one or more units some overall network optimizations (either stabilize a NILE network, decongest a NILE network, or decongest the overall Super Network).

8.2 Requirement

The Contractor **shall**[(1)] analyze, and document solutions to the problems described in paragraph 8.1 above and relevant subtasks. Later implementation will be decided after evaluation of the outcome of the analysis.

9. ITEM #08 (FORMERLY REGISTERED AS #26, ISSUE 2) – NETWORK MANAGEMENT RELATED EXPANSIONS, RADIO POWER MANAGEMENT

9.1 Problem description

The radio power management protocol in existence prior to implementation of the ISS phase Network Management Engineering Change Proposal (ECP) is not consistent with the order/compliance protocol used for all the network management orders implemented by the Network Management ECP during ISS phase's Block Cycle 2. Currently, if the SNMU or NMU wants to tell a NU to change its radio power, there is no way to include a time because the 'SPC Radio Power Request' (32DH) message does not contain a time.

One benefit of changing the protocol to an order is that the time for the ordered radio power change can be specified in the 'Order' (333h) message. Another benefit is that radio power changes will be treated in the same manner as other orders, thus giving consistency to the protocols. It is envisioned that the implementation of this item will lead into a non-backward compatible version of the SNC.

9.2 Requirement

The Contractor **shall**[(1)] implement and document a solution to the problem described in

paragraph 9.1 above.

10. ITEM #09 (FORMERLY REGISTERED AS #50) – BULK DATA / FILE TRANSFER PROTOCOL

10.1 Problem description

In a former period of NILE ISS Phase, Item 50 was analyzed and respective White Paper #32 was generated. The original scope of this item was to develop a bulk data or file transfer protocol by using the low overhead NP structure and unused CSM. While the analysis of the item was fully accomplished, the implementation was deferred for the following reasons:

1. The use of Bulk Data Transfer is not clearly defined:
   - Concept of employment (Operational Requirement) does not exist
   - DLP to DLP Operational Requirements are not defined
   - SNC to SNC Technical Requirements are not defined
   - Size or type of file is not specified
2. It would have led into a non-backward compatible version of the SNC.

10.2 Requirement

The Contractor **shall**[(1)] refine the already accomplished analysis and design a solution allowing for the resolution of the problem as described in paragraph 10.1 as well as an assessment of the cost effectiveness of its resolution. The task would consist of collecting national and operational requirements and produce a trade-off study highlighting cost/benefits of a new protocol or expand the use of existing STANAG 5522 FJ28.0 and J16.0. This task should be performed at the same time of Extension of Retransmission to DLP TSRs.

10.3 Reference Material

White Paper #32 (see paragraph 4.3 of the main body).

11. ITEM #10 (FORMERLY REGISTERED AS #51) – TIMESLOT SPACE UTILIZATION AND PADDING PROBLEMS

11.1 Problem description

In a former NILE ISS Phase, Item 51 was assessed. The original scope of this task was to utilize the padding bits inserted in the unused space of NPs to improve error detection. A

set of zero or more Padding Bits was supposed to be inserted in the remaining capacity of a NP encoded using the Full Capability NP Structure which was too small to accommodate a Leg Injection Packet (LIP) or first fragment LIP. This task would have improved the detection of good/incorrect NPs and LNE convergence, when the LLC Integrity is not used, but further analysis was deferred for non-backward compatibility reasons. It is envisioned that the implementation of this item will lead into a non-backward compatible version of the SNC.

11.2 Requirement

The Contractor **shall**[(1)] analyze and design a solution allowing for the resolution of the problem as described in paragraph 11.1, as well as an conducting an assessment of the cost effectiveness of its resolution.

12. ITEM #11 - NEW HF FF WAVEFORMS IMPLEMENTATION

12.1 Problem description

New waveforms are already designed and have been proposed by some NILE Nations to achieve higher capacity and extended range in HF FF medium. This task will finalize a solution for implementation of new WFs in the SNC and NRS which minimizes the impact on the entire Link 22, according to the NILE Nations needs, and in particular DLPs, including protocols such as LNE and probing. A parametric approach for accommodating new WFs in the Link22 system shall also be investigated in order to enable different waveforms usage and replacement, while reducing changes to the SNC code. A preliminary analysis of new WFs implementation has already been carried out; the outcome of this activity can be found in WP #31 (see paragraph 4.3 of the main body).

12.2 Requirement

The contractor **shall**[(1)] analyze and document a solution to the problem described in paragraph 12.1 above, given the following specific conditions:

- #1 [Implementation of new WFs in addition to existing WFs (MSN 1-6)]: Based on the outcome of the preliminary analysis, this would likely result in the use of more than one WF preamble, affecting specifically the LNE and probing protocols.

- #2 [Implementation of new WFs by replacing existing WFs (MSN 1-6)]: Based on the outcome of the preliminary analysis, this would likely result in the use of only one WF preamble, but affecting backward compatibility.

The contractor **shall**[(2)] provide a detailed analysis for both conditions, including a trade-off assessment regarding impacts to the overall Link 22 system and cost effectiveness. Subsequently, the contractor **shall**[(3)] document and implement a solution to the problem described in paragraph 12.1 above, either with or without replacing the existing WFs (MSN 1-6). The Contractor **shall**[(4)] also support SPCs interoperability testing for the new HF FF waveforms and impact on the Link 22 system. This will include both NILE ISS lab testing execution and report and the support of testing performed at a Government laboratory.

12.3 Reference Material

White Paper #31 (see paragraph 4.3 of the main body).

13. ITEM #12 (FORMERLY REGISTERED AS #83) - ACTIVE TAPPING OF SNC TCP/IP INTERFACE

13.1 Problem description

In the Link 22 Diagnostics White Paper (WP #25) it stated the following in section 2.4.

"2.4 Optional SNC Interface Active Tapping

The ability to optionally actively tap the SNC to DLP and the SNC to LLC interfaces should be considered for future implementation. As these interfaces are not internal information but relates to the external interfaces, this is not part of the monitoring information. The white paper for Item 46 covers active tapping, and states that the SNC software should not be modified to extract what it sends on its interfaces. However for future diagnostic purposes, perhaps this facility should be considered. Then if a single computer NRS was used with physical LLCs the SNC to LLC interface messages could be internally extracted and provided to the NRS SG Extractor application so that they could be logged in the data extraction (DX) file. For the NRS configuration there is no requirement for the DLP to SNC interface to be actively tapped as Item 46 includes tapping this interface on the SG Server. However, when the SNC was run with a real DLP, this would allow tapping of the interface.

Any future implementation of the active tapping should be compatible with the NRS SG

Extractor (EX) application, after it has been improved to include active tapping (Item 46). The active tapping code from MS or SG server (when Item 46 is implemented) could be used as a template for the implementation within the SNC of active tapping, to ensure that the message format produce was compatible with SG EX. As the communication to SG EX is via TCP/IP then this interface would have to be implemented using TCP/IP. If not a new interface would have to be provided within the NRS."

This item has been generated to implement this option.
The external DLP to SNC TCP/IP interface and the SNC to physical LLC (not simulated) Ethernet interface currently has to be tapped passively using hardware (a hub or managed switch) and a dedicated physical Ethernet connection to the SG Extractor (SG EX) computer. The SG EX currently accesses the dedicated Ethernet port using special low level software (RawEther) to extract the TCP/IP messages. This task would put active tapping of the TCP/IP within the SNC so that any TCP/IP messages sent or received can optionally be sent to SG EX (via TCP/IP) in the same way as all the other actively tapped interfaces in the NRS.
The SG Extractor can already receive messages containing the interface messages from the SG Server and the LLC Simulator, and should not require any significant changes.
The goals are the following:

1. Simplify the tapping of external real DLP to SNC Interface, simplifying National I/O testing
2. Simplify the tapping of the SNC to physical LLC Interface, simplifying LLC & MLLC testing
3. Consistent with all other NRS active tapping
4. All active tapping software is completely under the control of NILE

There is no need for third party low level software that usually requires changes when the operating system is updated.

13.2 Requirement

The Contractor **shall**[(1)] analyze, document and implement a solution to the problem described in paragraph 13.1 above.

13.3 Reference Material

White Paper #25 (see paragraph 4.3 of the main body).

14. ITEM #13 (FORMERLY REGISTERED AS #85) - MULTIPLE PASSIVE TAPPING OF REAL DLPs

14.1 Problem description

In the former ISS contract Item 61 (Enable SG Extractor to be network independent) analysis White Paper (WP #3) it stated the following:

"2.4 Other Considerations for Real DLPs

The following are not part of the task, but are included here to provide a complete analysis of the topic.

Using Real DLPs

Currently SGEX looks up only SGSV's IP Address and expects it to be used for all DLPs because SGSV simulates all of the DLPs in the NRS. If a configuration is used that uses multiple real DLPs, or possibly multiple MLST3s, SGEX will only extract messages to/from the DLP or MLST3 that has the IP Address assigned to SGSV in the HOSTS file. SGEX could be expanded to allow extraction of multiple DLPs by including multiple DLP addresses in the HOSTS file, and adding code to SGEX to look up these new DLP HOSTS file entries. This would make it easier to debug Feedback Reports (FRs) that are run using real DLPs."

This item has been generated to implement this option.
Item 61 also listed the necessary changes in section 5.2 which was as follows:

"5.2 Multiple DLPs IP Addresses

This is the list of required changes:

1. *HOSTS file needs to be updated to include new DLP IP Addresses. SGEX needs to be updated to read and store the extra DLP IP Addresses.*
2. *A lab needs to be configured to run multiple real DLPs and also multiple MLST3s.*
3. *Integration testing needs to be performed with the two lab configurations.*
4. *Test procedures need to be written and executed. These should include tests with real DLPs, and tests with multiple MLST3."*

This task would allow using NRS DX to record testing involving multiple DLPs, simplifying the analysis of FRs.

14.2 Requirement

The Contractor **shall**[(1)] analyze, document and implement a solution to the problem described in paragraph 14.1 above.

14.3 Reference Material

White Paper #3 for Item 61 (see paragraph 4.3 of the main body).

15. ITEM #14 (FORMERLY REGISTERED AS #86) - DR FILTER ENHANCEMENT

15.1 Problem description

In the Item 57 (Filter Correction and Standardization) analysis White Paper (WP #21) in section "2.3 Possible Additional Enhancements" it stated the following:

"Both Message Monitor and DR currently provide only global filtering (a checkbox, on/off) for the following:

- *SG<->MS Messages*
- *NRS Specific SG<->SNCd Messages*
- *Operator Commands*
- *SG System Events*

SG<->MS Messages

Some of the SG<->MS Messages are verbose messages that are repeated at a high rate. The messages most commonly applicable during analysis are not repeated and occur infrequently. This means that analysis of the desired messages gets cluttered up by the irrelevant but repeating other SG<->MS messages. As with other interfaces, such as the SNC-DLP or Technical Messages, the filtering of these SG<->MS messages could be enhanced to allow filtering of individual SG-MS messages. To achieve this more precise filtering, a listbox could be added to the standardized filter dialog which enumerates each SG<->MS message, and would allow the selection of only the required messages.

NRS Specific SG<->SNCd Messages

The NRS Specific SG<->SNCd Messages could also be expanded into a new listbox as well. However, these messages are very few in number and uncommon in analysis. These messages only control initialization and termination of a run, and include only a SNCd heartbeat during the run. Due to these facts, there is very little benefit to the user in being able to filter "NRS Specific SG<->SNCd Messages" at the message level, and we would not recommend this.

Operator Commands

The Operator Commands could be moved into their own list box as well, however very little use is currently made of these, and we would not recommend this.

SG System Events

The SG System Events could be moved into their own list box as well. Of these messages it is very common to want to see only the RUN COMMANDED System Event without seeing all of the others. Currently, you have to filter them all on or all off. Putting them in their own list box would make analysis more efficient by making a commonly desired message easily accessible. An alternative to this would be to add a new checkbox specifically to enable the inclusion of the RUN COMMANDED system event, when all the other events were filtered out.

For any filtering options that were expanded from entire message categories to individual messages, the same expansion should also be made in the Message Monitor Colorization option. Currently messages can be colorized by category, such as "SG System Events," and this would need to be expanded to include each of the SG System Events if the Filtering options were expanded, to maintain a one-to-one correspondence between the two dialogs."

The design of the new standard filter window that resulted from Item 57 includes lists for all of the SG<->MS Messages and all of the "SG System Events", for future use. The ability to select the individual messages in the lists and use them in the filtering was not implemented.

This task has been generated to implement the ability to select individual messages in these groups and use the selection in the filtering. No changes will be needed to the layout of the standard filter window.

In Item 58 (DR Time Tag Selection) analysis White Paper in section 4 "Additional Issues found during Analysis" it stated the following:

"4. ADDITIONAL ISSUES FOUND DURING ANALYSIS

DX time is only for internal use and starts from an arbitrary point (when the NRS was previously re-initialized). To have any meaning, this extraction recording time has to be converted into a time that means something, which is currently converted into simulated time. An option to display the DX time can be included, but it is unlikely to be used. For example the DX time may be a large number of hours if the previous initialization occurred many days previously.

DR currently allows the selection of a start and stop time for the analysis of a DX file, however the time inputs are DX time, which means that a user has to calculate the difference between the simulated time and DX time and use this value to calculate the start and stop times into DX time. If this time range selection is used the timetags are actually formatted in DX time not simulated time, showing that the formatting code currently has the ability to format DX time. This selection only works if the DX time is less than 24 hours. This selection of a time period should use the same time type as selected for the timetags."

This task also includes the improvement to the DR time period selection, to be able to use either Scenario or Simulated time (as selected for timetags) in addition to the current DX Time. The modifications would include the specification of the day number, to process long recording files and to handle over midnight.

15.2 Requirement

The Contractor **shall**[(1)] analyze, document and implement a solution to the problem described in paragraph 15.1 above.

15.3 Reference Material

White Papers #20 and #21 for Item 57 (see paragraph 4.3 of the main body).

16. ITEM #15 – LLC/MLLC SIM ALARM GENERATOR

16.1 Problem description

Testing of SNC handling of alarms from the LLC currently relies on physically being able to generate then by disconnecting cables etc. This is an unreliable method and difficult to repeat reliably. This task would be to modify the LLC simulator and the NRS to be able to script and reliably generate the alarms so that the handling of alarms by the SNC could be more rigorously tested.

This mechanism would be used in the same way for any changes in the list of MLLC alarms that may affect the behavior of the SNC. This capability would allow easier testing of changes in MLLC behavior, prior to the availability of an MLLC device.

16.2 Requirement

The Contractor **shall**[(1)] analyze, document and implement a solution to the problem described in paragraph 16.1 above.

17. ITEM #16 – ALERTS & ERRORS TIME TAG SELECTION

17.1 Problem description

Currently the Alerts & Errors window of the NRS SG Workstation displays messages with DX Time tags. These are not relevant to the scenario or simulated time and are therefore difficult to relate to the scenario that is running. This has become more apparent since the message monitor windows can display either Scenario or Simulated time (Item 58) and DX time is hardly ever used any more. Each Message Monitor window can independently select the time tag format using the universal filter screen. The setting for the Alerts window could be set to the same as the message monitor window, but which of the two? The time tag format should be able to be selected independently from the settings of the message monitor windows, but should have the same default setting.

This task has been generated to add a time tag selection pull down menu in order to select Scenario, Simulated or DX time to be displayed in SG Workstation Alerts & Errors window. The setting would also apply to the last alert line on the main SG Workstation display, and as the alerts window may be hidden, the selection list could be added to the main dialogue, next to the ‘Alerts’ button. The best location would be decided during implementation.

This would provide the ability to see when Alerts & Errors occur with respect to the events in the scenario or to the simulated time. This would save the time needed to calculate the scenario or simulated time from the displayed DX Time for the Alerts or Errors displayed. This saves time when analyzing scenario problems, which occur regularly when testing and developing scenarios, and so the future savings should be significant and therefore this improvement would be cost effective.

17.2 Requirement

The Contractor **shall**[(1)] analyze, document and implement a solution to the problem described in paragraph 17.1 above.

18. ITEM #17 (FORMERLY REGISTERED AS #55) - NRS DEFAULT FILE LOCATIONS

18.1 Problem description

The former ISS contract SOW states:

"2.17 Item 55 – All file opens should default to the last location of the type

2.17.1 Problem description

When opening a file using the NILE Reference System applications, the default locations used are not as useful as they could be, and the user has to browse to find the correct location. Correction of this problem shall ensure that for each file type that is opened, a default location is set by a data file, and that once a user browses to a new location, the default location is used for all further opening of that type of file by that application.

2.17.2 Requirement

The contractor ***shall****(1) analyze and design a solution allowing for the resolution of the problem as described in paragraph 2.17.1, as well as an assessment of the cost effectiveness of its resolution."*

The most cost effective solution is to implement this only in the places in the NRS where multiple file names have to be specified and it defaults to the location of the previous file open which is of a different type. This is notably in the DR application where .dx file, .dr file, .dbms file and message filter files are selected from the same screen. It should be implemented in a generic way so that it can easily be applied to other locations in the NRS.

18.2 Requirement

The Contractor **shall(1)** analyze, document and implement a solution to the problem described in paragraph 18.1 above.

19. ITEM #18 – UNNECESSARY MESSAGES IN LNE PROTOCOL

19.1 Problem description

While analyzing the code it was noted that if the LNU did not request capacity and is

already in the MASN, the LNU still waits for a 'LNE RESPONSE' technical message from the SU before completing the protocol, when it does not need to. An improvement would be to let it proceed without waiting for the message if capacity was not requested and the LNU is not in the current ONCS. The LNU could enter the network as a receive-only NU as soon as it receives the current media parameters and ONCS.

Determination of whether the NU is in the network membership MASN can only be performed when the MASN component of the SN Directory is up-to-date, as the NU may be in the old version of the MASN that the NU has, but may have been removed in a later version. So until the SN Directory realignment is complete it must be assumed that the LNU is not in the MASN. If the SN DIR realignment is completed and the LNU is in the network membership MASN, waiting for a 'LNE RESPONSE' technical message is only needed when capacity was requested and the NU is not in the ONCS.

There may be other cases where it is not necessary to send all the messages involved with the complete protocol thereby saving bandwidth. The shortcuts applied to the Inactive Join LNE could also be applied to Active Join LNE. A future task could be to do a complete analysis of the LNE protocol and identify all unnecessary message transmissions.

19.2 Requirement

The Contractor **shall**[(1)] analyze, document and implement a solution to the problem described in paragraph 19.1 above.

19.3 Reference Material

PRC #82 issued during the former ISS contract period of performance.

20. ITEM #19 (FORMERLY REGISTERED AS #81) - NMU'S SN DIR UPDATE OF DTDMA FLAG

20.1 Problem description

In a former period of NILE ISS Phase FR #57 was raised and analyzed. FR's analysis listed a possible improvement to the message flows to make the DLP-SNC interface more consistent.

The DLP-SNC IDD shows the DTDMA change message flows in the following figure.

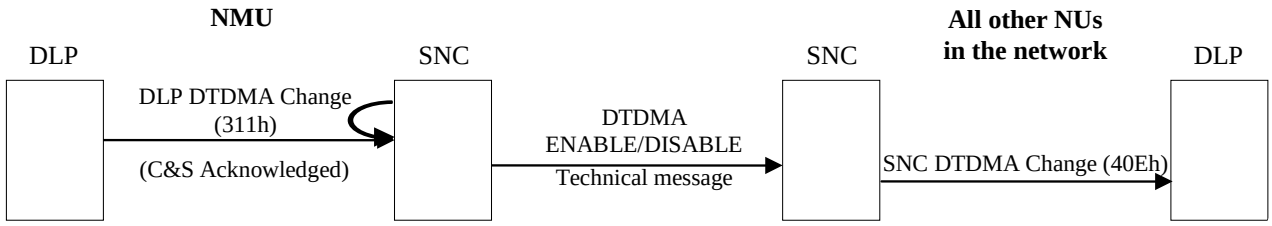


FIGURE 3.2.4.5.3.1-2. DTDMA CHANGE

The DLP of all other NUs in the network know the flag has been changed, and can update their copy of the SN Directory, when they receive the 'SNC DTDMA Change' (40Eh) message. However, the DLP of the NMU does not receive this message, and has to have a different mechanism to trigger the update of its SN Directory.

If the DLP of the NMU wants to change the DTDMA status of a network it sends the 'DLP DTDMA Change' (311h) message to the SNC. As long as this is positively acknowledged it can update its SN Directory with the new flag setting.

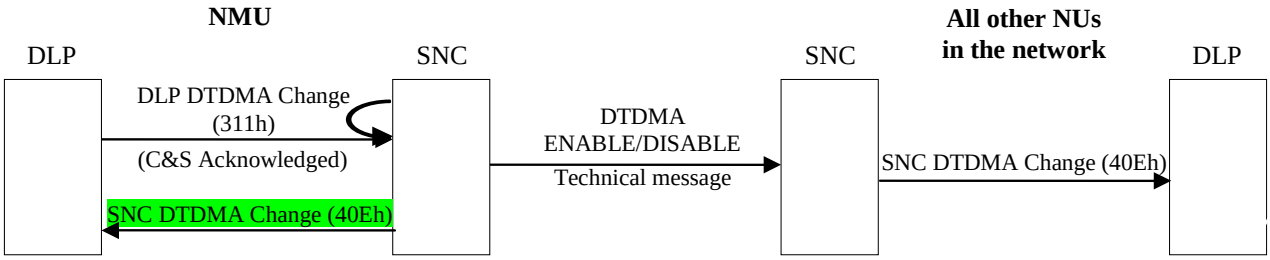
However the change can be ordered by the SNMU, in which case the DLP of the NMU will receive a 'Received Order' (428h) message with the appropriate Network Management Function set to Re-configuration (DTDMA ON) or (DTDMA OFF). If the ACS and APFS are both ON then the 'Information Only Flag' will be set and the DLP should not need to do anything, however in this case it needs to update the flag in the SN Directory.

If the ACS is OFF then the DLP will have to send an 'Order Compliance' (334h) message to the SNC. The flag in the SN Directory could be updated if a WILCO is sent to the SNC which is positively acknowledged and the APFS is ON.

If the APFS is OFF the DLP has to send the 311h message to the SNC, and the DLP could update the flag when a positive 'SNC C&S Acknowledgement' (421h) message is received

All these cases are before the SNC has actually performed the reconfiguration, which might fail and it would be better to update the flag once it is know it has been changed in the SNC.

The interface would be more consistent if the SNC of the NMU sent the 'SNC DTDMA Change' (40Eh) message to the DLP, as shown in the modified figure below (highlighted in green). Then the DLP would not need any of the additional special case code above to determine when to update its SN Directory, and it would also know that the SNC had completed the reconfiguration.



The processing of the 'SNC DTDMA Change' (40Eh) message by the DLP is mandatory as defined in the minimum implementation section at the end of the DLP-SNC IDD. Therefore all DLPs must be able to process the message. The only possible impact on a DLP is that any current special code to handle the system would become redundant, however if it currently works it would still work and so the DLP should not be affected.

Current versions of the DLP have to process the reception of the 'SNC DTDMA Change' (40Eh) message, and so having the DLP of the NMU receive this message should not affect backward compatibility.

20.2 Requirement

The Contractor **shall**[(1)] analyze, document and implement a solution to the problem described in paragraph 20.1 above

20.3 Reference Material

White Paper #36 for Item 81 (see paragraph 4.3 of the main body).

APPENDIX D - REFERENCE DOCUMENTATION AND PRODUCT MAINTENANCE RESPONSIBILITY REGISTER

1 INTRODUCTION

This Annex, together with the content of paragraph 4 of the PWS, provides a full list of the technical reference documentation applicable to this contract and identifies those documents, which the Contractor is required, as a minimum, to maintain (update, correct, amend, etc.) as a consequence of the activities that will be performed according to the Appendix C and of the provision of Engineering Support Services.

Proprietary rights on current and modified documents, software and hardware are as addressed in the RFP, Section K certification of the DFARS 252.227-7017 Identification and Assertion of Use, Release, or Disclosure Restrictions. Documents listed in paragraph 2.1 below are to be maintained and updated as described in this PWS and its Appendixes.

2 DOCUMENTATION LIST

The table below constitutes the initial list of documents and version numbers. The Government will provide most current, applicable dates and version numbers of the documents at Contract Award. This table may be updated throughout the lifetime of the contract. The CMIS Document Database will document the current baseline.

2.1 Link-22 System, SNC and NRS related documents

	Title	Document #	Version	Date
1	Data Extraction and Reduction Document	NG ___ DERD	As per BC 6	
2	Interface Design Description for the DLP-SNC	NG ___ DLPIDD	As per BC 6	
3	Interface Design Description for the NRS	NG ___NRSIDD	As per BC 6	
4	Interface Requirement Specification for the Link Level COMSEC Segment	NG ___ LLCIRS	As per BC 6	
5	Media Simulation Software Requirement Specification	NG ___ MSSRS	As per BC 6	
6	NILE Requirements Traceability Matrices	NILE REQTM	As per BC 6	
7	Scenario Generator Software Requirement Specification	NG ___ SGSRS	As per BC 6	

	Title	Document #	Version	Date
8	Segment Specification for the Signal Processing Controller of the Link 22 system	NG ___ SPCSS	As per BC 6	
9	Segment Specification for the System Network Controller	NG ___ SNCSS	As per BC 6	
10	Software Design Description for the System Network Controller	NG ___ SNCSDD	As per BC 6	
11	System Specification for the NILE Reference System	NG ___ NRSSS	As per BC 6	
12	System Technical Manual for the NILE Reference System	NG ___ NRSSTM	As per BC 6	
13	System Technical Manual for the System Network Controller	NG ___ SNCSTM	As per BC 6	
14	Glossary	NG ___ Glossary	As per BC 6	
15	Link 22 Guidebook	NG ___L22 Guidebook	As per BC 6	